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Ogden, Utah



Forest Insect and Disease Conditions

Intermountain Region

1989



PHOTOGRAPHER: K. Andrew Knapp
Forest Pest Management
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COVER STORY: Initial eradication efforts aimed at eliminating the gypsy moth from a 1,200-acre block in the Olympus Cove area of Salt Lake City, Utah, began in 1989. *Bacillus thuringiensis*, a biological insecticide which is toxic to moths and butterflies but poses very little threat to other nontarget organisms, was applied using the Bell 206 B3 helicopter pictured on the cover of this publication. The infested area was treated three times at 7-day intervals. Post-treatment larval and egg mass counts indicated a 95 percent reduction in larval numbers and a 98 percent reduction in egg masses. Additional eradication efforts are planned for 1990.

FOREST INSECT AND DISEASE CONDITIONS

Intermountain Region

1989

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INTRODUCTION

This report briefly summarizes the status of insect and disease pests of forest trees in the Intermountain Region. Status of diseases is based largely on ground observations and surveys. Status of insects is based primarily on annual and special aerial surveys conducted over approximately 14 million forested acres in 1989 and, to a lesser extent, ground-based detection and evaluation surveys.

Numbers of trees killed and acreage of defoliation displayed in tables are estimates based on aerial survey information. These estimates are rounded to the nearest 100 units in the narrative.

Since information is collected in a similar manner each year, the information from maps and tables from various year's reports can be compared to determine trends.

RESUME OF CONDITIONS

Mountain pine beetle activity continued to decrease throughout the Region with 40,000 trees killed in 1989 compared to 63,000 trees in 1988. Static to decreasing levels of tree mortality occurred throughout all infested areas with the exception of the Manti-LaSal and Dixie National Forests, where significant increases in tree mortality were observed. Small infestations continue to kill trees on the Challis, Salmon, and Sawtooth National Forests in southern Idaho.

Two new spruce beetle infestations, totaling 12,200 trees, were detected during aerial surveys on the Manti-LaSal National Forest in southern Utah. Tree mortality in the largest spruce beetle infestation in the Region, located on the Payette National Forest in southern Idaho, declined from 44,800 trees in 1988 to 32,100 trees in 1989.

Large increases in Douglas-fir beetle activity occurred throughout all forests in southern Idaho, the Wasatch-Cache National Forest in northern Utah, and the Bridger-Teton National Forest in western Wyoming. Approximately 190,200 trees were killed in 1989 compared to 87,600 trees in 1988. This is the largest Douglas-fir beetle outbreak ever recorded in the Region.

Ponderosa pine stands on the Boise and Payette National Forests in southern Idaho continued to be devastated by the largest western pine beetle infestation ever recorded in the Region. During 1989, approximately 53,200 trees were killed.

The first large fir engraver beetle infestation recorded in the Region caused extensive tree mortality on the Boise National Forest in southern Idaho and on the Toiyabe National Forest in western Nevada. Approximately 149,600 trees were killed.

Scattered tree mortality caused by the western balsam bark beetle occurred on the Bridger-Teton National Forest in western Wyoming, the Wasatch-Cache National Forest in northern Utah, and the Caribou, Sawtooth, and Targhee National Forests in southern Idaho. Regionwide, approximately 37,200 trees were killed.

Killing of Jeffrey pine by the Jeffrey pine beetle increased on the Toiyabe National Forest in Nevada with approximately 14,700 dying trees observed during aerial surveys.

Record low temperatures accompanied by high winds in February 1989 caused widespread foliar discoloration and mortality to conifers across southern Idaho, western Wyoming, and northern Utah. Damage was most widespread on the Bridger-Teton National Forest and Grand Teton National Park. Hail defoliated approximately 2,000 acres of subalpine fir on the Boise National Forest.

Acreage of defoliation by western spruce budworm remained low with approximately 10,900 acres of defoliation detected. Defoliation was located on the Targhee, Challis, and Salmon National Forests in southern Idaho.

A gypsy moth eradication program was conducted in Utah following the discovery of a small gypsy moth population in Salt Lake City, Utah, in 1988. An aerial application of the biological insecticide *Bacillus thuringiensis* (B.t.), was applied to 1,200 infested acres. Further eradication efforts are planned for 1990. Gypsy moths were detected in southern Idaho, Wyoming, and Utah.

Cytospora canker of true firs caused branch mortality to subalpine firs throughout central and eastern Idaho, western Wyoming, and northern Utah.

ENTOMOLOGY

BARK BEETLES

Increases in bark beetle activity occurred throughout the Region. With the exception of mountain pine beetle, all major bark beetles are at epidemic levels. The largest Douglas-fir and western pine beetle infestations ever recorded in the Region are causing extensive tree mortality throughout respective host types across southern Idaho. Two beetles, the fir engraver and western balsam bark beetle, which usually are not significant tree killers in the Intermountain Region are at epidemic levels throughout portions of Idaho, Utah, and Nevada.

Estimates of beetle-caused conifer mortality summarized from aerial detection surveys are displayed in Table 1. Ownership status of lands infested by the various bark beetles is summarized in Tables 2 through 8. Locations of major beetle infestations are identified in Figures 1 through 6.

Mountain Pine Beetle, *Dendroctonus ponderosae* Hopkins

Trees killed	1989	40,200
	1988	63,000

IDAHO

Boise, Caribou, Payette, and Targhee National Forests - Scattered mortality occurred throughout the host type.

Challis National Forest - Tree mortality decreased with 6,700 dead lodgepole pines detected in 1989 compared to 15,700 trees in 1988. Mortality is located along the Salmon River and adjacent drainages. Heaviest infestations occurred in the Yankee Fork and Squaw Creek drainages.

Salmon National Forest - Activity remained static with 6,100 dying trees detected in 1989. Mortality is located along Panther Creek and other drainages adjacent to the main Salmon River.

Sawtooth National Forest - Lodgepole pine mortality remained relatively static with 12,400 trees killed in 1989 compared to 11,700 trees in 1988. Decreases in activity occurred throughout the Big Wood River drainage from Ketchum north to Galena Summit and throughout the Deer Creek and Warm Springs Creek drainages. Increases in tree mortality occurred throughout the Sawtooth Valley.

UTAH

Ashley and Wasatch-Cache National Forests - Most susceptible host type on these Forests was killed during the massive infestation from 1975 to 1985. Very little current beetle activity was detected.

Dixie National Forest and Bryce Canyon National Park - Ponderosa pine mortality increased with 2,500 trees killed in 1989 compared to 900 trees in 1988. Mortality was scattered throughout the Forest and Park.

Manti-LaSal National Forest - Tree mortality doubled with 1,200 dying ponderosa pine trees detected. Mortality is concentrated in the Abajo Mountains near Gooseberry Guard Station.

WYOMING

Bridger-Teton National Forest and Grand Teton National Park - A 4-year decline in mountain pine beetle activity was reversed during 1989 with an increase in beetle-attacked lodgepole and limber pine observed throughout the Forest and Park. Approximately 5,600 dying trees were detected in 1989 compared to 3,200 trees in 1988.

Spruce Beetle, <i>Dendroctonus rufipennis</i> (Kirby)
--

Trees killed	1989	46,900
	1988	47,100

IDAHO

Boise, Caribou, Challis, Salmon, and Targhee National Forests - Endemic activity occurred throughout host type.

Payette National Forest - Approximately 32,100 trees were killed by spruce beetle on the Forest during 1989, a 20 percent decrease in mortality from 1988. Decreases in mortality occurred in commercial forest areas on the McCall, New Meadows, and Council Ranger Districts while increases in mortality occurred in remote, nonaccessible areas on the McCall Ranger District. Salvage and sanitation programs continue in commercially accessible areas.

UTAH

Dixie National Forest - Small, isolated pockets of spruce beetle activity are present throughout areas with sufficient host type. Forestwide, only 100 fading trees were detected during aerial detection surveys; however, ground reports indicate building populations in some areas.

Fishlake National Forest - Spruce beetle activity remained static with 800 dying trees detected over areas surveyed. Mortality occurred throughout the Beaver River drainage and in scattered pockets on the Richfield and Loa Ranger Districts.

Manti-LaSal National Forest - Two large spruce beetle infestations were detected during aerial surveys. The largest infestation comprising approximately 10,000 trees is located east of Manti along the Wasatch Plateau. A smaller infestation totaling approximately 2,000 trees occurred along the LaSal Mountains on the Moab Ranger District.

Uinta and Wasatch-Cache National Forest - Low levels of spruce beetle-caused mortality were observed throughout areas surveyed.

WYOMING

Bridger-Teton National Forest and Grand Teton National Park - Spruce beetle activity remained static on the Forest and increased in the Park. Approximately 300 trees were killed on the Bridger-Teton National Forest. Mortality was scattered along the Greys and Hoback River drainages. In Grand Teton National Park, approximately 200 trees were killed along the Snake River south of Moran Junction and north of Jackson.

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopkins

Trees killed	1989	190,200
	1988	87,600

IDAHO

Boise National Forest - A massive expansion in Douglas-fir beetle activity occurred throughout the Forest. Approximately 72,000 trees were killed in 1989 compared to 33,800 in 1988. This is the largest Douglas-fir beetle outbreak recorded on the Forest. Virtually every susceptible large stand of Douglas-fir on the Forest has significant mortality. Mortality centers range in size from 15 trees to over 1,000 trees. Beetle activity continued in and around recent burns.

Caribou National Forest - Douglas-fir beetle activity continued to increase on the Caribou National Forest. Approximately 19,100 dead trees were observed in 1989 compared to 5,000 trees in 1988. South of Pocatello on Bureau of Land Management, State, private, and Indian Reservation lands, approximately 12,500 trees were killed. Activity is located throughout the Caribou, Bear River, and Portneuf Ranges and in the Scout Mountain, Oxford Peak, and Samaria Mountains.

Challis National Forest - Increasing levels of Douglas-fir beetle activity were detected on all areas surveyed.

Payette National Forest - Increases in Douglas-fir beetle activity occurred throughout the host type with approximately 25,800 beetle-attacked trees mapped in 1989 compared to 18,900 in 1988. Heavy mortality was located in the Hitt and Cuddy Mountains, near Sturgill Peak, throughout the West Mountains, and throughout the South Fork of the Salmon River drainage. Continued beetle activity occurred in and around the French and Savage Creek burns.

Salmon National Forest - During 1988, less than 1,000 trees were killed on the Forest; while during 1989, 9,700 trees were killed. Increases in beetle-caused tree mortality occurred throughout the Panther Creek drainage and along drainages adjacent to the main Salmon River.

Sawtooth National Forest - Douglas-fir beetle activity increased fourfold with approximately 16,100 trees killed during 1989. Mortality is concentrated throughout drainages adjacent to the South Fork of the Boise River and along Lime Creek on the Fairfield Ranger District. Elsewhere, extensive mortality occurred throughout the Sublett and Black Pine Mountains on the Burley Ranger District.

Targhee National Forest - Increases in Douglas-fir beetle activity occurred throughout the Forest. Approximately 13,300 trees were killed in 1989 compared to 3,100 in 1988. Increases in mortality occurred throughout the Centennial, Big Hole, and Teton Mountain Ranges and along Big Bend Ridge.

UTAH

Manti-Lasal National Forest - Approximately 2,800 Douglas-fir beetle-killed trees were detected on the Forest during 1989, a substantial increase over 1988 mortality levels. Extensive and increasing mortality occurred on the west side of the Wasatch Plateau.

Wasatch-Cache National Forest - Increases in Douglas-fir beetle activity occurred throughout the host type surveyed. Approximately 7,500 beetle attacked trees were mapped during aerial surveys compared to 1,200 trees in 1988. Extensive mortality occurred along the Bear River Range south of Soda Springs, Idaho, and throughout Logan Canyon.

WYOMING

Bridger-Teton National Forest - The number of Douglas-fir trees killed by Douglas-fir beetle doubled with approximately 9,300 dying trees detected during 1989. Heaviest beetle activity occurred along the Greys River drainage, throughout the Salt River Range and in the Gros Ventre Mountains southeast of Jackson, Wyoming.

Western Pine Beetle, *Dendroctonus brevicomis* LeConte

Trees killed	1989	53,200
	1988	42,700

IDAHO

Boise National Forest - Second-growth ponderosa pine stands in the Idaho City area continued to sustain heavy losses from western pine beetle attacks. Approximately 42,700 fading trees were mapped in 1989 compared to 32,300 trees in 1988. Extensive mortality continued to occur throughout areas of recent fire activity (3 to 5 years) particularly in and around the Anderson Creek burn.

Payette National Forest - Approximately 10,500 trees were killed by western pine beetle during 1989 compared to 8,800 trees in 1988. Mortality centers were located throughout the Weiser River drainage, along the Little Salmon River, and throughout the French Creek burn.

Pine engraver beetle, *Ips pini* (Say)

IDAHO

Boise, Payette, and Salmon National Forests - Mortality attributed to pine engraver beetles occurred throughout areas of ponderosa pine and was often associated with western pine beetle activity.

NEVADA

Toiyabe National Forest - Pine engraver activity occurred throughout areas of Jeffrey pine and was frequently associated with Jeffrey pine beetle activity.

Jeffrey Pine Beetle, *Dendroctonus jeffreyi* Hopkins

Trees killed	1989	14,700
	1988	1,500

NEVADA

Toiyabe National Forest - Jeffrey pine mortality attributed to Jeffrey pine beetle increased throughout susceptible host type. Approximately 14,700 trees were killed during 1989 compared to 1,500 in 1988.

Extensive mortality occurred throughout Dog Valley, along the east side of the Carson Range, and throughout the Markleeville area. Increasing levels of Jeffrey pine beetle activity were observed in the Mt. Charleston area on the Las Vegas Ranger District.

Fir Engraver Beetle, <i>Scolytus ventralis</i> LeConte
--

Trees killed	1989	149,600
	1988	0

IDAHO

Boise National Forest - Approximately 17,300 grand fir trees were killed by the fir engraver beetle during 1989 compared to infrequent single tree attacks observed over the last several years. Mortality was located along Squaw Creek, near Sage Hen Reservoir, and along the North and Middle Forks of the Payette River. This is the first large fir engraver beetle infestation recorded on the Forest.

Payette National Forest - Widespread fir engraver beetle activity occurred in grand fir throughout the Council, New Meadows, and McCall Ranger Districts.

NEVADA

Toiyabe National Forest - Fir engraver beetle activity increased significantly throughout stands of white fir on the Forest. Approximately 900 mortality centers totaling 132,400 trees were observed during aerial surveys. While virtually all white fir stands were infested, heaviest tree mortality occurred around Lake Tahoe on Forest Service, State, and private lands. Elsewhere, tree mortality was located along the east side of the Carson Range and throughout the Markleeville area.

Western Balsam Bark Beetle, <i>Dryocetes confusus</i> Swaine
--

Trees killed	1989	37,200
	1988	0

IDAHO

Caribou National Forest - Extensive western balsam bark beetle activity occurred throughout sub-alpine fir stands. Approximately 18,700 trees were killed on Forest Service, State, private, and Indian Reservation lands. Mortality was located south of Pocatello along the Deep Creek, Portneuf, and Bannock Ranges.

Sawtooth National Forest - Approximately 5,200 subalpine fir trees were killed on the Forest during 1989. Mortality was concentrated throughout the Albion Mountains south of Burley.

Targhee National Forest - Tree mortality was scattered throughout host type on the Forest with approximately 1,600 dying trees detected during aerial surveys.

UTAH

Wasatch-Cache National Forest - Western balsam bark beetle activity was apparent over much of the Forest; however, only selected areas were surveyed. In those areas surveyed, approximately 8,800 dying trees were observed. Extensive mortality was located near the headwaters of Blacksmith Fork south of Bear Lake.

WYOMING

Grand Teton National Park - Pockets of beetle-killed subalpine fir occurred throughout host type in the Park. Approximately 2,900 trees were killed during 1989 with mortality centers located from Moran Bay south to Phelps Lake. Elsewhere, significant mortality was located south of Emma Matilda Lake.

DEFOLIATORS

Damage by defoliators dropped to record low levels throughout the Region. Western spruce budworm activity continued to decline in extent and intensity with only 10,900 acres of light defoliation observed on the Targhee, Salmon, and Challis National Forests. Acreages of trees defoliated by the western spruce budworm, and ownership status of infested lands, are summarized in Tables 9 and 10. Areas of budworm defoliation are displayed in Figure 7.

Small scattered areas of aspen defoliation were observed infrequently on Forests in Utah. No other major outbreaks of defoliating insects were observed.

Western Spruce Budworm, <i>Choristoneura occidentalis</i> Freeman
--

Acres defoliated	1989	10,900
	1988	42,300

IDAHO

Challis National Forest - Defoliation decreased from 6,200 acres in 1988 to 200 acres in 1989. Defoliation was located near Oster Gulch north of the Salmon River.

Salmon National Forest - Approximately 300 acres of light defoliation were observed during 1989 compared to 5,800 acres in 1988. Defoliation was located near the Cobalt Ranger Station.

Targhee National Forest - Approximately 10,300 acres of light defoliation were recorded on the Forest compared to 28,700 in 1988. All defoliation mapped was classified as light. Defoliation occurred along Big Bend Ridge north of Ashton.

Douglas-fir Tussock Moth, *Orgyia pseudotsugata* (McDunnough)

IDAHO

No defoliation was noted during aerial detection surveys.

Pheromone-baited detection traps were placed on the Boise, Payette, and Sawtooth National Forests; State and Bureau of Land Management lands around Bellevue, Idaho; and in the Owyhee Mountains of southwestern Idaho. Survey results indicate decreasing or static populations on the Boise, Payette, and Sawtooth National Forests. Trap catches increased at Little Water Gulch on the Sawtooth National Forest and remained high at Dewey Peak on Bureau of Land Management lands in the Owyhee Mountains.

Larval sampling was conducted at several sites as part of an early warning system designed to detect impending outbreaks. At the Dewey Peak site, larval populations were classified as suboutbreak. At all other sample sites, larval populations were very low.

Gypsy Moth, *Lymantria dispar* L.

IDAHO

Twenty-seven developed sites on National Forest land plus 53 cities or towns were monitored with pheromone-baited detection traps in southern Idaho in cooperation with the Idaho Departments of Agriculture and Lands. A total of seven moths were captured in a residential development in Idaho Falls. In addition, a single moth was trapped on the Idaho State University campus in Pocatello. An intensive delimiting survey will be installed in Idaho Falls in 1990 in order to more precisely locate potential infestations.

UTAH

The gypsy moth was first detected in Utah in July of 1988. Gypsy moth life stage surveys were conducted to establish initial levels of infestation, against which treatment effectiveness would be measured. Egg mass densities in the FY 1989 proposed treatment area ranged from 80 to 4,240 per acre. Based on the survey information, a 1,200-acre block in the Olympus Cove area of Salt Lake City was treated with three applications of the biological insecticide *B.t.* The three treatments were spaced at 7-day intervals; spray dates were May 11, 18, and 25.

The *B.t.* applied was Dipel 8L (16 BIU's per acre) at a formulation rate of 96 oz. per acre - 1:2 mixture, 1 part Dipel to 2 parts water with 2 percent Plyac sticker. Post-treatment larval and egg mass counts indicated a 95 percent reduction in larval numbers and 98 percent reduction in egg masses.

Two additional infested sites were found in early June in Provo and Bountiful. Approximately 30 acres were treated at both sites involving 30 residential sites in Provo and 85 residential sites in Bountiful. Each city contracted with commercial applicators to apply the chemical insecticide Orthene using ground equipment.

WYOMING

A total of four moths were caught in pheromone-baited detection traps. A multiple catch was recorded in Thermopolis.

Large Aspen Tortrix, <i>Choristoneura conflictana</i> (Walker)

Acres defoliated	1989	1,000
	1988	6,900

UTAH

Dixie National Forest - Small, scattered pockets of aspen defoliation, likely caused by the large aspen tortrix, occurred infrequently throughout the Forest.

Fishlake National Forest - Approximately 300 acres of defoliated aspen were mapped along Iant Ridge on the Beaver Ranger District.

Intermountain Region--Status of Insects In southern Idaho, Nevada, Utah, and western Wyoming

Insect	Host	Location	Remarks
Alder flea beetle <i>Altica ambiens</i>	Alder	Idaho	Defoliation of alder was noted in the Mann Cr. drainage on the Payette National Forest, ID.
Black grass bugs <i>Labops hesperius</i> <i>Irbisia pacifica</i>	Range grasses	Idaho	Large numbers of black grass bugs were noted killing range grasses on the Mountain Home Ranger District, Boise National Forest, ID.
Cooley spruce gall adelgid <i>Adelges cooleyi</i>	Spruce	Idaho	Infestations were detected in forested areas and on ornamental hosts throughout southern Idaho.
Douglas-fir pole beetle <i>Pseudohylesinus nebulosus</i>	Douglas-fir	Idaho	Infestations of Douglas-fir pole beetle were noted killing tops and branches of large trees along with poletimber and saplings throughout southern Idaho.
Douglas-fir beetle <i>Dendroctonus pseudotsugae</i>	Douglas-fir	Idaho, Utah, Wyoming	Activity increased in 1989 with 190,200 trees killed by Douglas-fir beetle. Increases in beetle activity occurred on the Boise, Caribou, Challis, Payette, Salmon, Sawtooth, and Targhee National Forests, ID; on the Bridger-Teton National Forest, WY; and on the Wasatch-Cache National Forest, UT.
Douglas-fir tussock moth <i>Orgyia pseudotsugata</i>	Douglas-fir	Idaho	No defoliation was observed, but moths were detected in pheromone-baited traps in southern Idaho.
Fir engraver beetle <i>Scolytus ventralis</i>	Grand fir, White fir	Idaho, Utah, Nevada	Extensive areas of grand fir on the Boise and Payette National Forests, ID, and white fir on the Toiyabe National Forest, NV, were killed. In Utah, mortality was located on the Wasatch-Cache National Forest.
Gypsy moth <i>Lymantria dispar</i>	Hardwoods	Idaho, Utah, Wyoming	A total of seven moths were captured in pheromone-baited traps in Idaho Falls, ID, and a single moth in Pocatello, ID. In Utah, 1,200 acres in Salt Lake City were treated with three applications of B.t. In Wyoming, pheromone-baited traps caught four moths with a multiple catch in Thermopolis.
Jeffrey pine beetle <i>Dendroctonus jeffreyi</i>	Jeffrey pine	Nevada	Mortality of Jeffrey pine increased with 14,700 trees killed on the Toiyabe National Forest, NV.

Status of insects in southern Idaho, Nevada, Utah, and western Wyoming--Continued

Insect	Host	Location	Remarks
Large aspen tortrix <i>Choristoneura conflictana</i>	Aspen	Utah	Defoliation occurred infrequently throughout Utah.
Locust borer <i>Megacyllene robiniae</i>	Black locust	Idaho	Locust borer continues to kill black locust trees in Boise, ID.
Mountain pine beetle <i>Dendroctonus ponderosae</i>	Lodgepole pine, Ponderosa pine, Other pines	Idaho, Utah, Wyoming	Mountain pine beetle activity decreased throughout the Region. Tree mortality decreased from 63,000 trees in 1988 to 40,000 trees in 1989. Significant infestations occurred on the Boise, Challis, Salmon, and Sawtooth National Forests, ID; and on the Manti-LaSal National Forest, UT.
Pine butterfly <i>Neophasia menapia</i>	Ponderosa pine	Idaho	Defoliation was not noted, but small numbers of adults were observed in ponderosa pine stands.
Pine engraver beetle <i>Ips pini</i>	Pines	Idaho, Nevada	Mortality often associated with western pine beetle activity was noted throughout southern Idaho. In Nevada, mortality was often associated with Jeffrey pine beetle activity.
Pine needle sheathminer <i>Zelleria haimbachi</i>	Lodgepole pine	Idaho	Defoliation decreased in 1989. Scattered infestations persisted on the Boise, Payette, Sawtooth, and Targhee National Forests, ID.
Spruce beetle <i>Dendroctonus rufipennis</i>	Engelmann spruce	Idaho, Utah, Wyoming	Two new large infestations, totaling 12,200 trees were detected on the Manti-LaSal National Forest, UT. Approximately 32,100 infested trees were killed on the Payette National Forest, ID--a decrease from 1988. Smaller infestations occurred on the Bridger-Teton National Forest, WY; and on the Dixie and Fishlake National Forests, UT.
Spruce bud scale <i>Physokermes piceae</i>	Spruces	Idaho	Infestations of spruce bud scales have been detected on ornamental spruces scattered throughout southern Idaho.
Sugar pine tortrix <i>Choristoneura lambertiana</i>	Pines	Idaho	This insect, often associated with pine needle sheathminer, continued to cause scattered defoliation of both lodgepole and ponderosa pines.

Status of Insects in southern Idaho, Nevada, Utah, and western Wyoming--Continued

Insect	Host	Location	Remarks
Western balsam bark beetle <i>Dryocoetes confusus</i>	Subalpine fir	Idaho, Utah, Wyoming	Approximately 37,200 trees were killed during 1989. Mortality was located on the Bridger-Teton National Forest and Grand Teton National Park, WY; on the Wasatch-Cache National Forest, UT; and on the Caribou, Sawtooth, and Targhee National Forests, ID.
Western pine beetle <i>Dendroctonus brevicornis</i>	Ponderosa pine	Idaho	Significant activity often associated with pine engraver beetle activity increased throughout southern Idaho. Approximately 53,200 trees have been killed by these two species of beetles. Infestations occurred on the Boise, Payette, and Salmon National Forests, ID.
Western plineshoot borer <i>Eucosma sonomana</i>	Ponderosa pine	Idaho	Scattered infestations were noted in ponderosa pine plantations on the Boise and Payette National Forests, ID.
Western spruce budworm <i>Choristoneura occidentalis</i>	Douglas-fir, Spruce, True firs	Idaho	Conifers on about 10,700 acres were defoliated in 1989 compared to 42,300 acres in 1988. Infestations were located on the Boise, Salmon, and Targhee National Forests, ID.

PATHOLOGY

STEM AND BRANCH DISEASES

Stem and branch diseases of forest trees are not closely monitored because change in incidence is difficult to detect for several years. Those diseases occurring in Region 4, but whose status is not known to have changed significantly, are noted only in the summary table at the end of this report.

Cytospora Canker of True Firs, *Cytospora abietis*

Investigation of "branch flagging," dead and dying branches, on subalpine fir revealed cankers from which spore tendrils of the canker-causing fungus, *Cytospora abietis*, were being produced. Occurrence of the disease was widespread throughout central and eastern Idaho, western Wyoming, and northern Utah in 1989. The epidemic is undoubtedly due to the widespread drought from 1986 to 1988 that debilitated host trees making them susceptible to infection by this normally weak parasite. Since high levels of this disease often precede attack by the western balsam bark beetle, increasing beetle-caused subalpine fir mortality can be anticipated in affected areas.

Dwarf Mistletoes, *Arceuthobium* spp.

Dwarf mistletoe management considerations are generally included in forest plans and specifically in silvicultural prescriptions for all land management activities in the Region. These plans, and our decade-long technology transfer effort, stress management of the parasite through conventional forest management practices. There is still a need, though dwindling, for supplemental projects to sanitize previously harvested stands, or areas ravaged by bark beetles, where infected trees remain and now threaten infection of established regeneration. Accomplishments for 1989 are reported in Table 11.

Distribution of limber pine dwarf mistletoe (*Arceuthobium cyanocarpum*) in Nevada has been poorly documented in the past. This dwarf mistletoe species parasitizes limber pine, Great Basin bristlecone pine, and whitebark pine. The parasite was found for the first time on limber pine in the following Nevada mountain ranges: North Snake Mountains (White Pine County), Toiyabe Mountains (Lander and Nye Counties), Bull Run Mountains (Elko County), Santa Rosa Mountains (Humboldt County), and the White Pine Mountains (Esmeralda County).

Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*) was found in the Albion Mountains, Black Pine Range, and Sublett Range in southcentral Idaho during an extensive forestwide disease survey of the Sawtooth National Forest. These are the first reports of this dwarf mistletoe species in these areas. In addition, lodgepole pine dwarf mistletoe (*Arceuthobium americanum*) was noted for the first time in the Sublett Range. The occurrence of both parasitic species in these areas was uncommon.

ROOT DISEASES

As with stem and branch diseases, root diseases of forest trees are difficult to monitor on an annual basis. Known root pathogens of forest trees are noted in the summary table. Diseases, primarily root diseases, causing root malformation and mortality of nursery grown seedlings are closely monitored, and their status is briefly discussed.

Root Disease of Nursery Seedlings, *Fusarium* spp., *Pythium* spp., *Phytophthora* spp.

Three genera of potential conifer seedling root pathogens were monitored at the Lucky Peak Nursery, Boise National Forest, prior to and following fumigation with a granular application of dazomet. There were wide variances in population levels of *Fusarium* spp., *Pythium* spp., and *Phytophthora* spp. notably between fields. While post-fumigation levels of all three fungi were sufficiently reduced initially, *Fusarium* spp. populations resurged to levels comparable to control plots within 2 months.

FOLIAGE DISEASES

Douglas-fir Needle Cast, *Rhabdocline* sp.

The epidemic of Douglas-fir needle cast fungus noted throughout southern Idaho in 1988 subsided.

VASCULAR WILTS

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Mor.

The City of Boise, Idaho, has a street-tree population of around 1,500 elm trees, down from over 4,000 trees a decade ago. In 1989, 41 trees succumbed to dutch elm disease. The long-range plan for the City is to replace elms with trees requiring less maintenance.

ABIOTIC DAMAGE

Winter Injury

Severe winter injury of conifers, particularly on lodgepole pine, Douglas-fir, and junipers occurred in eastern Idaho, western Wyoming, and northern Utah. All sizes of trees were affected with damage ranging from group tree mortality to minor needle necrosis of youngest needle tips. The most severe damage occurred on approximately 24,100 acres, primarily of lodgepole pine, on the Island Park and Ashton Ranger Districts of the Targhee National Forest, the Buffalo Ranger District on the Bridger-Teton National Forest, and throughout Grand Teton National Park.

Elsewhere in the Region, winter injury symptoms were evident, notably on ponderosa pine around Council, Idaho; but damage was generally limited to foliage discoloration. It is likely that the widespread damage occurred because affected trees were desiccated by a week of strong winds accompanied by record-breaking cold temperatures that produced an extreme moisture deficit in trees already stressed by 3 years of drought.

Hail Damage

Approximately 2,300 acres of subalpine fir were extensively defoliated during a severe, late spring hail storm west of Cascade Reservoir along the West Mountains.

Intermountain Region--Status of diseases in southern Idaho, Nevada, Utah, and western Wyoming

Disease	Host	Location	Remarks
Stem and Branch Diseases			
Aspen trunk rot <i>Phellinus tremulae</i>	Aspen	Idaho, Nevada, Utah, Wyoming	Decay occurs in most aspen stands in the Region.
Comandra blister rust <i>Cronartium comandrae</i>	Lodgepole pine, Ponderosa pine	Idaho, Utah, Wyoming	Infection occurs infrequently throughout Idaho, Utah, and Wyoming.
Cytospora canker of true firs <i>Cytospora abietis</i>	Subalpine fir, Grand fir	Idaho, Utah	Widespread branch flagging was noted, often preceeding attack by western balsam bark beetle.
Dwarf mistletoes <i>Arceuthobium</i> spp.	Douglas-fir, Lodgepole pine, Ponderosa pine, Western larch, Jeffrey pine	Idaho, Nevada, Utah, Wyoming	These continue to be the most widespread and frequently observed pests in southern Idaho. Suppression projects removed infected overstory trees from 3,643 acres.
Limb rust <i>Peridermium filamentosum</i>	Ponderosa pine	Utah	Infection was detected in stands on the Dixie National Forest, UT.
Red ring rot <i>Phellinus pini</i>	Western larch, True firs, Spruce, Douglas-fir, Pines	Idaho, Utah, Wyoming	This fungus occurs throughout the Region in stands of mature conifers. Infection intensity is highly variable.
Rust-red stringy rot <i>Echinodontium tinctorium</i>	Grand fir, White fir, Subalpine fir	Idaho, Nevada	Decay caused by this fungus is common in mature and overmature stands of true firs.
Stalactiform blister rust <i>Cronartium coleosporioides</i>	Lodgepole pine	Idaho, Utah, Wyoming	This rust occurs in localized areas of host type across the Region. Heavy infection has been noted in several areas on the Salmon, Sawtooth, and Targhee National Forests, ID.
Western gall rust <i>Endocronartium harknessii</i>	Lodgepole pine, Ponderosa pine	Idaho, Utah, Wyoming	Gall rust occurs throughout host types. Infection levels are highly variable.

Status of diseases in southern Idaho, Nevada, Utah, and western Wyoming--Continued

Disease	Host	Location	Remarks
Root Diseases			
Annosus root disease <i>Heterobasidion annosum</i>	Douglas-fir, Lodgepole pine, Ponderosa pine, True firs, Engelmann spruce	Idaho, Nevada, Utah, Wyoming	This fungus commonly causes root and butt rot of true firs and root rot of young ponderosa pines. Infection frequently results in outright death of young ponderosa pines and predisposition to beetle attack in true firs. Infrequent root infection has been noted on Douglas-fir.
Armillaria root disease <i>Armillaria</i> sp.	Douglas-fir, Grand fir, Pines, Spruce	Idaho, Utah, Wyoming	While evidence of <i>Armillaria</i> may be found throughout the Region, in most instances it functions as a weak pathogen or saprophyte.
Black stain root disease <i>Ceratocystis wagneri</i>	Pinyon pine	Idaho, Nevada, Utah	This disease infects pinyon pine on the BLM Burley District, ID; on the Humboldt and Toiyabe National Forests, NV; and on the Manti-LaSal National Forest, UT.
Schweinitzii butt rot <i>Phaeolus schweinitzii</i>	Douglas-fir, Ponderosa pine	Idaho	Decay is common in mature and overmature forests, especially those having a recent fire or logging history. The fungus is often found associated with other root diseases and bark beetles.
Tomentosus root disease <i>Inonotus tomentosus</i>	Douglas-fir, Spruce, Subalpine fir	Idaho, Utah	The fungus is commonly found with <i>P. schweinitzii</i> as a root/butt rot of pole-size Douglas-fir and spruce--less often of subalpine fir--in southern Idaho. Infection may result in occasional mortality.
Foliage Diseases			
Ash yellows	Velvet ash	Nevada, Utah	In addition to an infection center located in Las Vegas, NV, Zion National Park is the only other reported site in the western U.S.
Douglas-fir needlecast <i>Rhabdocline</i> spp.	Douglas-fir	Idaho	Infrequent occurrence was observed with light to moderate defoliation noted throughout the range of Douglas-fir in southern and eastern Idaho.
Elytroderma disease <i>Elytroderma deformans</i>	Ponderosa pine	Idaho	Moderate levels of infection were noted in stands on Little Donner Summit, Cascade, ID, and around Idaho City, ID.
Fir broom rust <i>Melampsorella caryophyllacearum</i>	Subalpine fir	Idaho, Utah, Wyoming	Infection occurs scattered throughout the host type, but high infection levels have been noted in forested areas south of Twin Falls and Burley, ID.

Status of diseases in southern Idaho, Nevada, Utah, and western Wyoming--Continued

Disease	Host	Location	Remarks
Fir needle cast <i>Lirula</i> spp.	Subalpine fir, Grand fir	Idaho	Infected stands were found on the Council and Weiser Ranger Districts of the Payette National Forest, ID.
Fir needle rust <i>Pucciniastrum</i> sp.	Subalpine fir	Idaho	Seedling or sapling size trees at higher elevations around McCall, ID, were heavily infected.
Larch needle cast <i>Meria laricis</i>	Western larch	Idaho	Incidence and severity of infection throughout the host type in west central Idaho were very low.
Lodgepole pine needle cast <i>Lophodermella concolor</i>	Lodgepole pine	Wyoming	Scattered incidence of light intensity was noted in southwestern Idaho.
Marssonina blight <i>Marssonina populi</i>	Aspen	Idaho, Utah, Wyoming	Scattered incidence of light to heavy intensity was noted throughout most of the host range.
Shepherd's Crook <i>Venturia macularis</i>	Aspen	Idaho	Scattered incidence of light intensity was noted in southwestern Idaho.
Spruce broom rust <i>Chrysomyxa arctostaphyli</i>	Engelmann spruce	Idaho, Utah, Wyoming	Scattered infections occurred throughout the host type, especially in eastern Idaho.
Abiotic			
Winter Injury	All vegetation	Regionwide	Tree mortality in all age and size classes due to record-breaking cold temperatures and high winds in eastern Idaho, western Wyoming, and northern Utah.
Nursery			
Fusarium Root Disease <i>Fusarium oxysporum</i>	Nursery grown conifer seedlings	Idaho	Minor mortality of 1-0 and 2-0 conifer seedlings occurred at the Lucky Peak Nursery, Boise National Forest, ID.
Fusarium Cortical Stem Rot <i>Fusarium avenaceum</i>	Nursery grown conifer seedlings	Idaho	Mortality of 1-0 and 2-0 conifer seedlings occurred at the Lucky Peak Nursery, Boise National Forest, ID.
Phytophthora/Pythium Root Rot <i>Phytophthora</i> spp. <i>Pythium</i> spp.	Spruce	Idaho	These fungi were identified on seedlings and soil isolations at the Lucky Peak Nursery, Boise National Forest, ID.

TABLE 1. Number of trees and acres killed by *bark beetles* in Region 4 during 1989 as determined by aerial detection surveys.

Forest* & Adjacent Land	Mountain Pine Beetle		Douglas-fir Beetle		Ips/Western Pine Beetle		Spruce Beetle		Fir Engraver Beetle		Western Balsam Bark Beetle		Jeffrey Pine Beetle		TOTALS	
	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Ashley	1,138	780	122	70	--	--	49	7	--	--	--	--	--	--	1,309	857
Boise	880	791	72,729	69,231	42,686	59,888	277	175	17,260	41,311	--	--	--	--	133,832	171,396
Bridger-Teton ¹	5,614	3,171	9,310	12,217	--	--	1,115	871	--	--	2,884	2,866	--	--	18,923	19,125
Caribou ²	636	378	31,652	23,402	--	--	--	--	--	--	18,659	11,957	--	--	50,947	35,737
Challis	6,703	10,586	1,279	1,227	--	--	--	--	--	--	--	--	--	--	7,982	11,813
Dixie	2,464	1,715	--	--	--	--	127	90	--	--	--	--	--	--	2,591	1,805
Fishlake	77	55	--	--	--	--	781	620	--	--	--	--	--	--	858	675
Manti-LaSal	1,184	1,888	2,793	1,936	--	--	12,176	8,845	--	--	--	--	--	--	16,153	12,669
Payette	367	603	25,779	37,711	10,476	27,151	32,108	26,451	--	--	--	--	--	--	68,730	91,916
Salmon	6,111	5,859	9,708	7,929	--	--	--	--	--	--	--	--	--	--	15,819	13,788
Sawtooth	12,399	6,630	16,052	12,362	--	--	--	--	--	--	5,228	14,068	--	--	33,679	33,060
Targhee	2,486	1,536	13,297	8,309	--	--	--	--	--	--	1,600	871	--	--	17,383	10,716
Tolyabe	--	--	--	--	--	--	--	--	132,387	72,784	--	--	14,710	8,087	147,097	80,871
Uinta	--	--	--	--	--	--	250	165	--	--	--	--	--	--	250	165
Wasatch-Cache ³	133	95	7,477	9,717	--	--	--	--	--	--	8,813	8,504	--	--	16,423	18,316
TOTAL	40,192	34,087	190,198	184,111	53,162	87,039	46,883	37,224	149,647	114,095	37,164	38,266	14,710	8,087	531,976	502,909

*Only portions of Forests flown; actual mortality figures are probably considerably higher.

¹ Includes Grand Teton National Park.

² Includes nearby Bureau of Land Management and State Land.

³ Includes portions of Forest administered by the Caribou National Forest.

TABLE 2. Status of *mountain pine beetle* infestations by state during 1989.

IDAHO

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	24.5	27.5
Other Federal	0.5	0.6
State and Private	1.4	1.5
TOTAL	26.4	29.6

UTAH

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	4.3	4.8
Other Federal	0.1	0.1
State and Private	0.1	0.1
TOTAL	4.5	5.0

WYOMING

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	2.8	5.0
Other Federal	0.4	0.6
State and Private	0.0	0.0
TOTAL	3.2	5.6

TABLE 3. Status of *spruce beetle* infestations by state during 1989.

IDAHO

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	25.3	30.8
Other Federal	0.0	0.0
State and Private	1.3	1.6
TOTAL	26.6	32.4

UTAH

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	9.7	13.4
Other Federal	0.0	0.0
State and Private	0.0	0.0
TOTAL	9.7	13.4

WYOMING

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	0.5	0.6
Other Federal	0.0	0.0
State and Private	0.4	0.5
TOTAL	0.9	1.1

TABLE 4. Status of *Douglas-fir* beetle infestations by state during 1989.

IDAHO

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	136.2	145.0
Other Federal	4.0	7.5
State and Private	20.0	18.0
TOTAL	160.2	170.5

UTAH

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	11.7	10.4
Other Federal	0.0	0.0
State and Private	0.0	0.0
TOTAL	11.7	10.4

WYOMING

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	10.7	8.3
Other Federal	0.5	0.5
State and Private	1.0	0.5
TOTAL	12.2	9.3

TABLE 5. Status of *western pine beetle* infestations by state during 1989.

IDAHO

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	72.2	44.2
Other Federal	1.7	1.0
State and Private	13.1	8.0
TOTAL	87.0	53.2

TABLE 6. Status of *Jeffrey pine beetle* infestations by state during 1989.

NEVADA

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	6.5	11.7
Other Federal	--	--
State and Private	1.6	3.0
TOTAL	8.1	14.7

TABLE 7. Status of *fir engraver beetle* infestations by state during 1989.

IDAHO

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	37.1	15.0
Other Federal	2.5	1.1
State and Private	2.5	1.1
TOTAL	41.3	17.2

NEVADA

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	58.2	106.0
Other Federal	--	--
State and Private	14.6	26.4
TOTAL	72.8	132.4

TABLE 8. Status of *western balsam bark beetle* infestations by state during 1989.

IDAHO

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	10.8	10.2
Other Federal	0.0	0.0
State and Private	16.1	15.3
TOTAL	26.9	25.5

UTAH

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	8.5	8.5
Other Federal	0.0	0.0
State and Private	0.0	0.0
TOTAL	8.5	8.8

WYOMING

Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
National Forest	0.0	0.0
Other Federal	2.8	2.9
State and Private	0.0	0.0
TOTAL	2.8	2.9

TABLE 9. Acres of defoliation by *western spruce budworm* in Region 4 during 1988-1989 as determined by aerial detection surveys.

		Defoliation Intensity				
Forest* and Adjacent Land	Year	Light	Moderate	Heavy	Total	Change
Boise	1989	0	0	0	0	
	1988	178	160	0	338	- 338
Challis	1989	248	0	0	248	
	1988	4,002	869	1,371	6,242	- 5,994
Salmon	1989	288	0	0	288	
	1988	4,313	1,335	164	5,812	- 5,524
Sawtooth	1989	0	0	0	0	
	1988	1,173	0	0	1,173	- 1,173
Targhee	1989	10,340	0	0	10,340	
	1988	20,797	1,444	6,451	28,692	- 18,352
R-4 TOTALS	1989	10,876	0	0	10,876	
	1988	30,463	3,808	7,986	42,257	- 31,381

*Only portions of Forests flown; actual acreage may be greater.

TABLE 10. Status of *western spruce budworm* by state during 1989.

IDAHO

Land Ownership Class	Outbreak Area (Thousand Acres)
National Forest	10.9
Other Federal	--
State and Private	--
TOTAL	10.9

TABLE 11. Dwarf mistletoe accomplishments - Intermountain Region, 1989.

National Forest	Presuppression Survey Acres	Suppression Project Acres
Ashley	0	207
Boise	44,200	200
Bridger-Teton	0	252
Caribou	10,600	92
Challis	90	140
Dixie	400	865
Fishlake	0	30
Payette	0	400
Salmon	0	219
Sawtooth	0	27
Targhee	0	500
Toiyabe	0	100
Uinta	0	0
Wasatch-Cache	0	800
TOTAL	55,290	3,832

Figure 1. Areas infested by mountain pine beetle and Jeffrey pine beetle in Region 4 during 1989 as observed during aerial detection surveys.

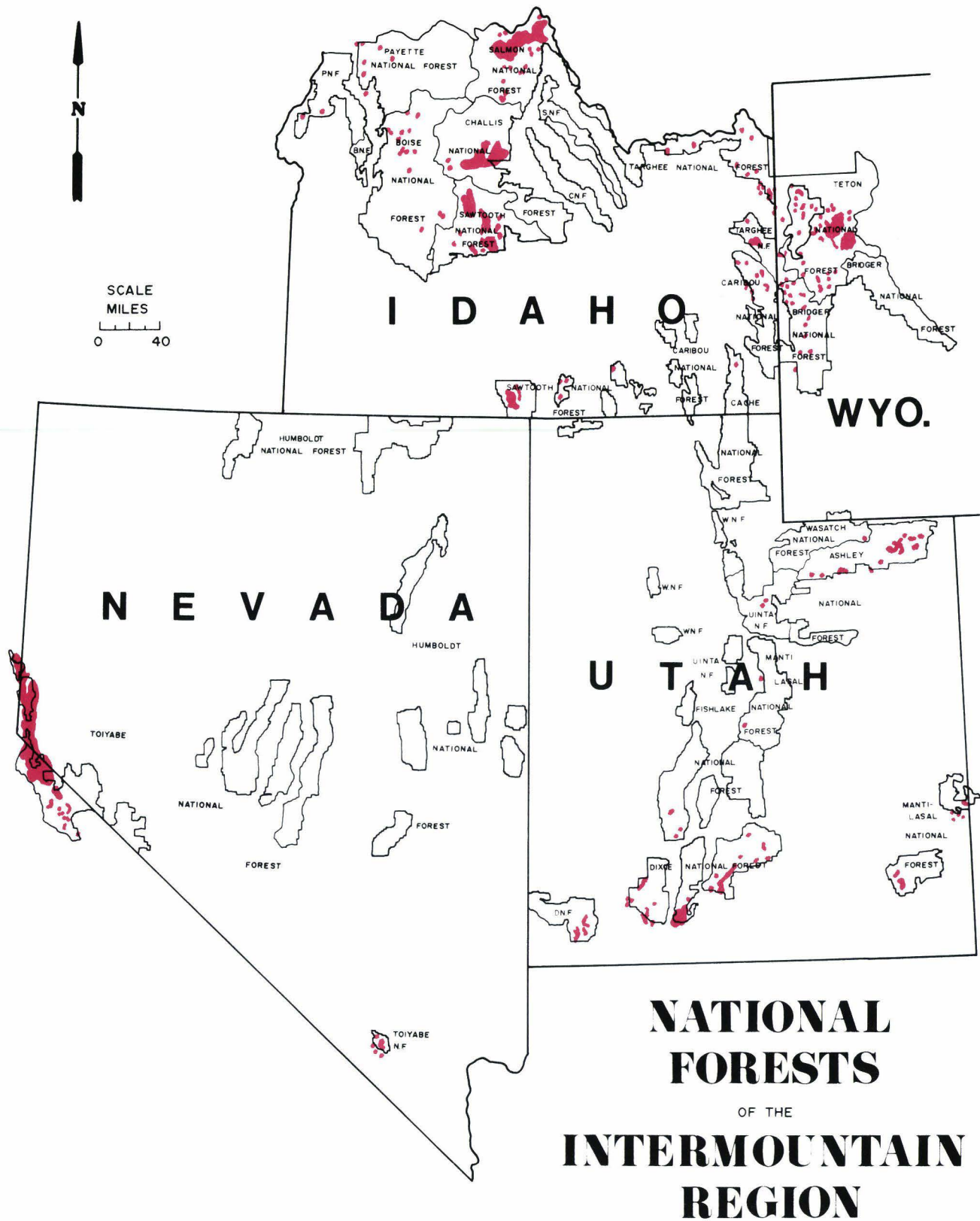


Figure 2. Areas infested by spruce beetle in Region 4 during 1989 as observed during aerial detection surveys.

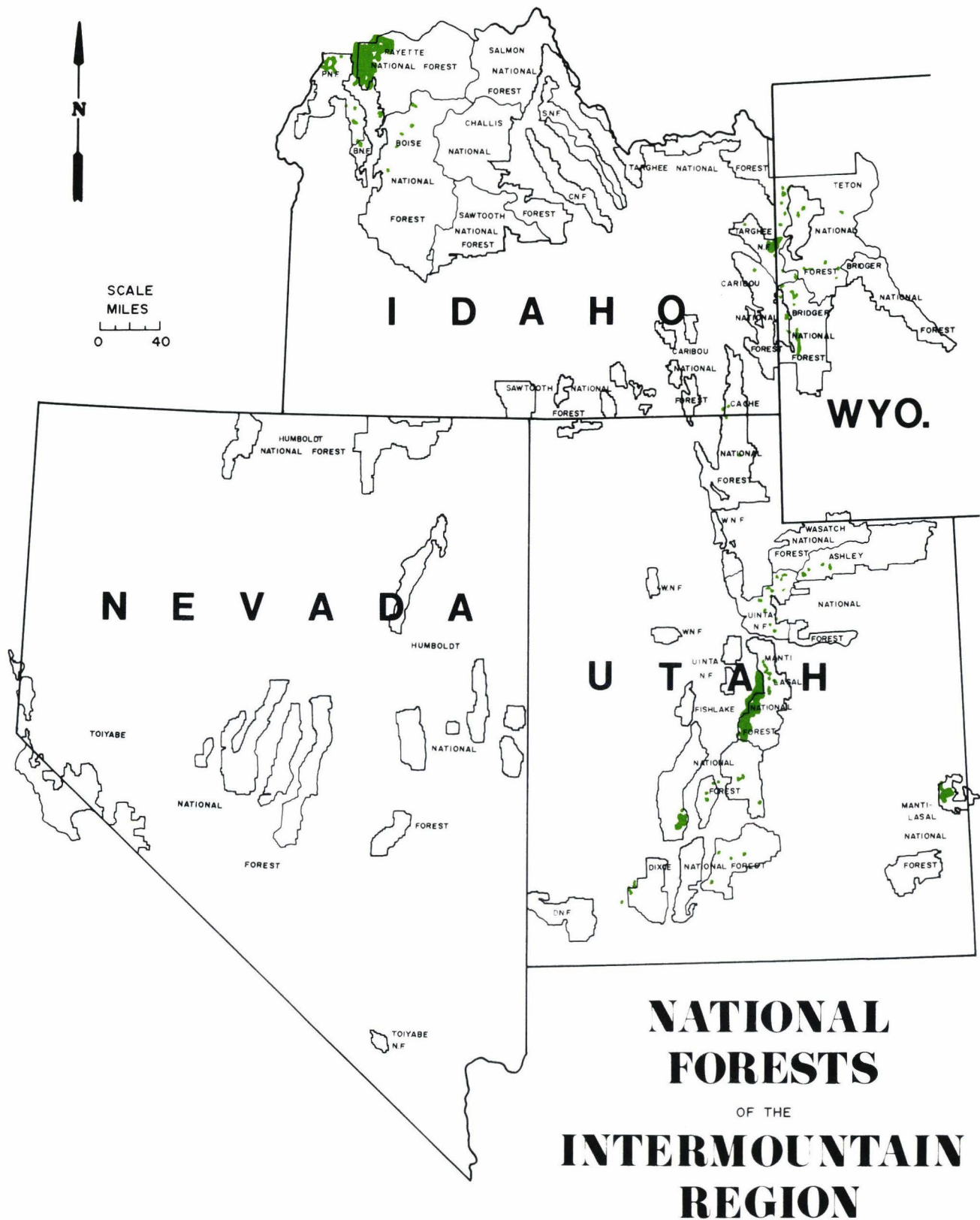


Figure 3. Areas infested by Douglas-fir beetle in Region 4 during 1989 as observed during aerial detection surveys.

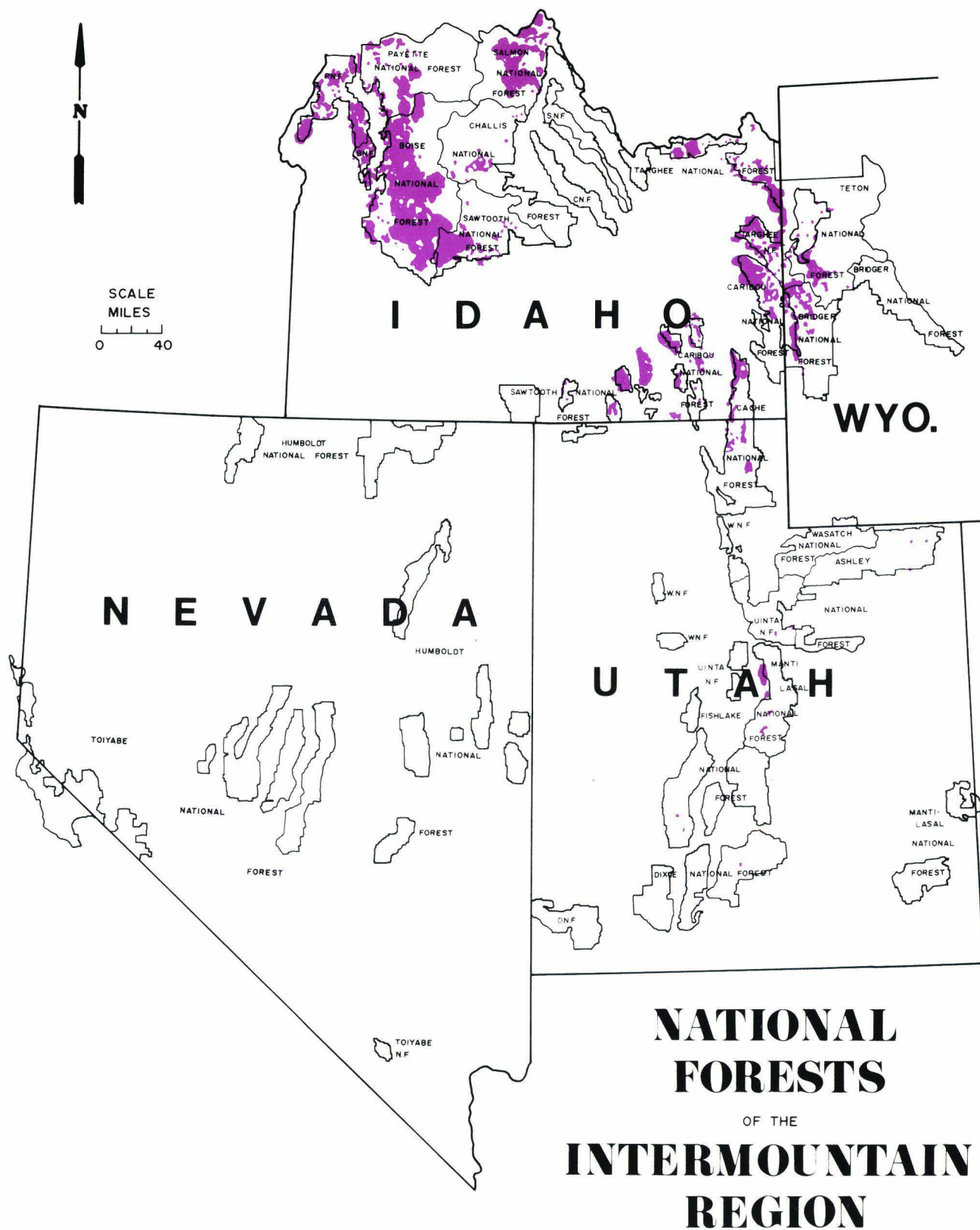


Figure 4. Areas infested by western pine beetle and pine engraver beetle in Region 4 during 1989 as observed during aerial detection surveys.



Figure 5. Areas infested by fir engraver beetle in Region 4 during 1989 as observed during aerial detection surveys.



Figure 6. Areas infested by western balsam bark beetle in Region 4 during 1989 as observed during aerial detection surveys.

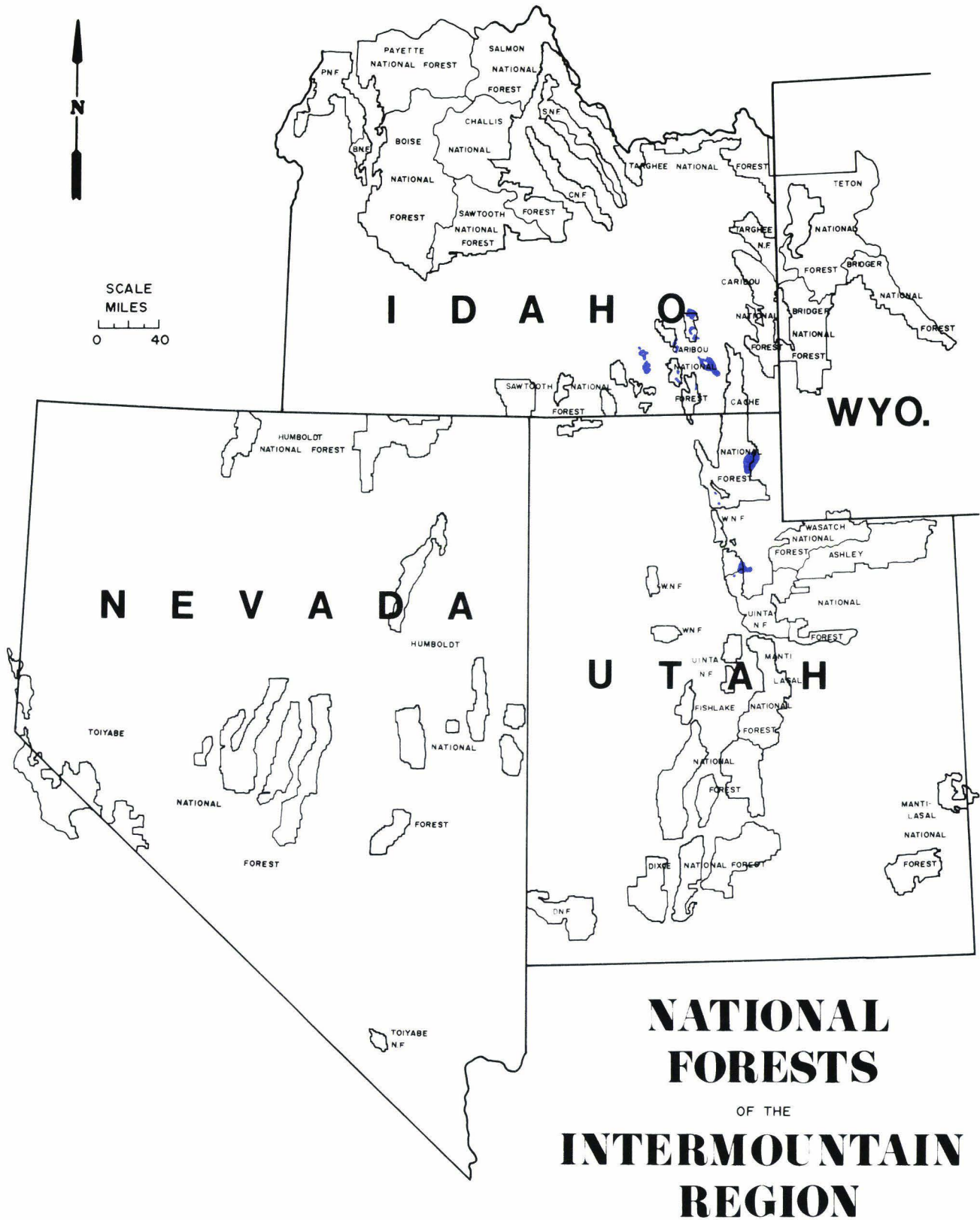


Figure 7. Areas infested by western spruce budworm in Region 4 during 1989 as observed during aerial detection surveys.



SPECIAL PROJECT UPDATE

Evaluation of a combined Carbaryl spray and bait strategy to reduce western pine beetle caused mortality in second-growth ponderosa pine stands in southern Idaho. This study, in progress on the Council Ranger District, Payette National Forest, examines the effect of establishing a variable number of "spray and bait" centers over a large area. One "spray and bait" center was established for each ten trees killed by western pine beetle in five, 640-acre test areas. A "spray and bait" center consists of a number of uninfested ponderosa pine trees sprayed with a registered insecticide, Carbaryl, and baited with a semiochemical attractant. Earlier studies have indicated that this technique is capable of manipulating beetle pressure over smaller areas, but an areawide influence has not been demonstrated. Evaluations are planned for 1990.

Semiochemical baiting efficiency for Douglas-fir beetle. Data are being analyzed for this project to determine if differences exist for semiochemical baiting densities for Douglas-fir beetle. This replicated, randomized project on the Idaho City Ranger District, Boise National Forest, examined beetle response to plots treated with varying numbers of semiochemical baits per acre.

Warm Fork timber sale semiochemical trial area. This study, located on the New Meadows Ranger District, Payette National Forest, encompasses a timber sale originally proposed for harvest from 1992 to 1997. With increased western pine beetle activity, the scope and concept of the sale was changed. The sale date was changed to 1989, the sale volume increased, and high-risk ponderosa pine units were to be harvested within 2 years. Special contract provisions were developed to accommodate semiochemical baiting of clearcut units. Aerial photography, both prior to and following harvest, will provide a means to evaluate the "bait and cut" technique and provide a record of harvest activity.

Thinning demonstration of dwarf mistletoe infected lodgepole pine on the Targhee National Forest. Sixteen, 100-tree plots were established on the Targhee National Forest in 1983 to demonstrate the effect of dwarf mistletoe on lodgepole pine spaced to different thinning regimes. Preliminary analysis of data from the first 5 years is underway.

Effectiveness of pyrethroid insecticides for protection of ponderosa pine from attack by western pine beetle. This study will attempt to determine the effectiveness of pyrethroid insecticides as a preventive spray against western pine beetle on ponderosa pine. Study areas are located on the Idaho City Ranger District, Boise National Forest.

Dwarf mistletoe control with ethephon. Final evaluation is being completed on a 2-year study, located on the Boise National Forest, to determine the effectiveness of the growth regulator, ethephon, to cause dwarf mistletoe shoot abscission on ponderosa pine infections.

Forestwide disease surveys. Pilot evaluations were conducted on the Sawtooth and Dixie National Forests, in Idaho and Utah, respectively, to determine the effectiveness of ground-based, forestwide insect/disease/damage incidence surveys.

Special assessment of the susceptibility of fire-damaged trees to attack by bark beetles. Seventy-two permanent plots were installed in moderately burned stands within the boundary of the Lowman fire on the Boise National Forest. Information describing crown, bole, and root damage was recorded for all trees (>5 inches d.b.h.) within each plot. These plots will be visited annually during the next 5 years in order to assess the frequency of beetle attacks in trees with various levels of damage and the survival rates of developing brood.

Special assessment of tree mortality and growth reduction in stands previously defoliated by western spruce budworm. Beginning in 1978, a series of permanent impact plots was installed in susceptible host type scattered throughout southern Idaho. Green stand information and defoliation estimates were recorded when the plots were originally installed. Stands on the Boise, Payette, and Salmon National Forests have been remeasured. These data will be summarized in an attempt to quantify rates of tree mortality and growth reduction in stands defoliated by western spruce budworm.

Special research project to evaluate mountain pine beetle response to different verbenone dosages in lodgepole pine stands. A cooperative field test of various rates of verbenone, a bark beetle antiaggregative semiochemical, was installed by personnel from Forest Pest Management and the Intermountain Research Station during 1989 in the Sawtooth National Recreation Area. This test was designed to determine an optimum treatment rate to prevent mountain pine beetle infestations in lodgepole pine stands. Preliminary data from the 1988 and 1989 tests indicate that 20 to 40 verbenone bubble caps per acre will reduce mountain pine beetle attack rates to acceptable levels.

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